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This paper includes (1) a review of the history and current activities in the area of intergovernmental cooperation in the exchange of information and (2) a summary of the current state of the art in the information sciences. Relevant federal legislation, dating back to the 1930's, is discussed; the April 1968 report by the Intergovernmental Task Force on Information Systems is summarized; and present federal, state, and local activities are described. In the examination of the information sciences, the technological background is reviewed, some of the technical resources currently available are described, and the system implications of information processing are discussed. Appended are statistics on the growth in the number and capability of computers and Chapter I of the report by the Intergovernmental Task Force on Information Systems, entitled "Summary--Plan of Action." The full Task Force report is available as ED-019-985. (JB)

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RECENT DEVELOPMENTS IN THE INFORMATION SCIENCES AND THEIR IMPLICATIONS FOR INTERGOVERNMENTAL COOPERATION IN COMMUNICATIONS AND EXCHANGE OF INFORMATION

by

William W. Parsons

One morning, perhaps tomorrow, a City Manager or a Cabinet Officer, or a Lieutenant Governor will stride from the elevator and cross the top floor executive suite, determined to get to the bottom of things. Upon reaching his office, he will shut the door, draw his chair up to the desk, activate his terminal, and proceed to have a conversation with his data base. That, in the current jargon of computerized information processing, is how he will get to the basic facts.

That, in truth, is how a few executives in a few large organizations today are beginning to secure the information they need for planning, organization, or control.

Watching one of them at work, you might see him call for a description of the kinds of data held in one or more files of the corporate data bank. Within a second or two, a precise table of contents appears before him, displayed either on video screen or teletype paper. Say two areas interest him. He requests a random sample that gives him some

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idea of the data characteristics. A quick sum-and-average establishes reference points. He probes deeper. He suspects a correlation and pursues it. The comparisons come out a little different than he anticipated. So he tries a different tack. He demands the display of a trend line. Then he queries further. He plays a hunch. The data corroborates his new theory. He checks it out. One question leads to another. More confirmation. What does that mean? He retains one group of figures and switches to a different area--sifting, summing, thinking, until the new insight pays off. In twenty or thirty minutes, he has firm hold of an idea which the management committee will want to act upon at its next meeting. He thinks a moment about how best to present it, orders the computer to print a dozen copies in his preferred format, and terminates the conversation.

The executive who interacts this closely with a computer need not be a former programmer who rose through the ranks. In fact, he may have little knowledge of what goes on inside a computer, and care even less. But he will pick the machine's brain, directly and personally ("interactively," in computer jargon) nearly every day.

And, if we look ahead two or three years, he is unlikely to be the only one in his organization working in this fashion, for the technology is too ready, the advantages of on-line computer use too compelling, the implementation of interactive data management systems too easy and too economical for an effective organization to withhold direct computer access from its star technical and management performers.

Before moving on to more fanciful thinking, as it may seem, let me take a few moments to review some of the history and current happenings in the area of intergovernmental cooperation in the exchange of information among the various levels of government. After doing this, I shall return and continue my story about the current state of the art in the information sciences.

Federal legislation in the 1930's and even more abundant enactments of recent date to improve the conditions in our society have led to significant changes in the pattern of intergovernmental action. Increasingly, federal, state, and local governments are being brought together to act as partners in carrying out programs that are designed to meet public needs. This places a high premium on close cooperation and a steady flow of information. All levels of government have been slow to change their habits and develop new methods of working together. This is particularly true with respect to the development and use of information systems.

The requirements imposed by the federal grant-in-aid programs beginning in the 1930's inevitably led to an increased volume of exchange of information flowing through the supervisory and reporting processes. Prior to this time there had been considerable exchange of information of a census nature, but very little of this exchange bore directly upon the operating of programs. The one most important exception to this generalization was in the field of tax information.

States have had access to federal tax returns since the beginning of federal taxation. In the early years, states were able to send agents to Washington to examine returns under formal agreement. The procedure was formalized by the Revenue Act of 1926 which opened the federal returns to state officials at the request of the governors. By the end of 1965, the District of Columbia, and twenty-nine of the thirty-four states with broad-based personal income taxes, had agreements with the Internal Revenue Service for the cooperative exchange of tax records. In general, the agreements provide for the establishment of mutually acceptable programs, the cooperative exchange of information allowing the federal and state governments to obtain each other's returns, and exchange of other necessary information to insure effective compliance. The Advisory Commission on Intergovernmental Relations has been particularly influential with regard to this entire area of cooperative exchange of information.

Of particular interest with respect to the development and use of information systems among the three levels of government is the recent report by the Intergovernmental Task Force on Information Systems, dated April 1, 1968. This report contains recommendations to improve the flow of information within and among federal, local, and state governments. It is the result of a study conducted by the Task Force and arranged by the Bureau of the Budget, Council of State Governments, National Association of Counties, National League of Cities, U.S. Conference of Mayors, International City Managers' Association, and the

Advisory Commission on Intergovernmental Relations. The purpose of the study was to:

(1) Identify impediments to attaining an effective flow of information within and among governments, and

(2) Recommend actions that could be taken at the federal, state, and local levels of government.

The Task Force concluded that intergovernmental approaches to the solution of public problems require that reliable information flow readily among those who share responsibility so that concerted action may be taken. In general, information systems now in use and current efforts to improve them are not geared to satisfy this requirement. The Task Force also stated that these conditions are traceable to a number of factors that impede the development of efficient flow of information. Among these factors are the lack of strong, central coordination at all levels of government over the development and operation of internal information systems, and the fragmentation of federal grant-in-aid programs available to assist state and local governments in this development. (See Attachment 1 for Chapter 1 of this report, entitled "SUMMARY--PLAN OF ACTION", which enumerates eleven factors in this connection.)

The recommendations of the Task Force total twenty specific items under the following general areas:

1. Improving information systems within governments.

2. Improving the exchange of information among governments. (An example in this connection is Recommendation 5 which reads:

> "Develop, under the leadership of the U.S. Bureau of the Budget, a standard 'package' of socio-economic data to be used as a base by Federal agencies in obtaining information from state and local governments.")

3. Strengthening information systems at the local level.

4. Sharing systems knowledge.

5. Achieving compatibility among systems.

6. Improving information about federal assistance programs.

7. Guidelines for action.

(Attachment 1 includes the entire listing of the twenty specific recommendations.)

Clark R. Penninger, as a member of the Intergovernmental Task Force, pointed out, in a paper entitled "TRENDS IN FEDERAL SUPPORT OF INFORMATION SYSTEMS", at the National Conference on Public Administration in Boston in March, 1968:

> "Among the many problems identified by the Task Force is the imbalance that exists within and among the three levels of government in their capability to be responsive partners in the development and exchange of useful information. As an illustration, experience in the application of computer technology to information systems tends to decrease as we move from the national to the local levels of government, although outstanding examples of computer uses can be found at all levels. This pattern exists rather naturally because the resources and opportunities for the use of computer techniques have been greatest at the federal level, less so at the state level, and much less so at the county and city level.
>
> "But in view of the accelerating trend toward cooperative intergovernmental programs, this imbalance needs to be corrected. The systems capability of state and local governments must be enhanced if they are to assume an effective role in these arrangements."

The most significant way in which the Federal Government involves itself in helping to meet this problem is by providing financial aid. A number of the federal grant-in-aid programs contain authorizations designed to aid state and local governments in improving their own information systems. Let me cite a few examples:

1. The National Defense Education Act (PL 85-864, Title X, Section 1009) provides grants to states to improve the statistical services of their educational agencies. The

Office of Education is authorized to provide grants to cover half the cost of such improvement programs, but no state may be paid more than $50,000 in any one fiscal year.

2. The State Technical Services Act of 1965 (PL 89-182) provides grants to establish State Technical Information Centers as a means for stimulating industrial and economic growth.

3. The Housing Act of 1954, as amended, provides grants to assist urban development planning programs in small communities, states, and metropolitan areas.

4. The Law Enforcement Assistance Act of 1965 (PL 89-197) provides grants to states, counties, and cities to develop new and better methods of crime prevention, law enforcement, and criminal law administration.

In addition to these rather specific kinds of assistance, there are other instances where expenses for the establishment and operation of information systems needed to manage grant programs are recognized as allowable charges to the grant.

Another way in which the Federal Government helps to improve

information system is by providing direct technical assistance. For example, the Office of Economic Opportunity sends teams of systems analysts to states to assist in the development of information systems patterned after a similar system operated by the OEO.

A third way in which the Government assists state and local governments is by providing federal facilities in the administration of the grant program. To illustrate, the Bureau of Census has prepared data files on population and housing in the form of punched cards and computer tapes that can be processed to provide a user with almost any kind of statistical summary or small-area tabulation he may desire.

Also, state and local governments are now authorized to use the federal ADP Service Centers of the General Services Administration.

In spite of these resources, the present system of grant-in-aid is much too complex to lead to anything except fragmentation. There are more than four hundred separate grant authorizations, each devoted to specific purposes and administered by more than twenty federal agencies, a fact that creates major problems of information flow. This leads to further complexity when state and localities seek help in unified information systems. Such proposals not only cross program lines but (obviously) agency lines.

There are varied current efforts and proposals before the

Congress to improve the situation and I am sure progress will be made, but it is quite evident that we shall be working on these problems against great odds for a long time to come and progress will undoubtedly be slow.

Those of you who are concerned with these various federal programs may find several documents useful in trying to achieve a better understanding of available resources at the federal level. One is entitled "CATALOG OF FEDERAL ASSISTANCE PROGRAMS", produced by the Office of Economic Opportunity. This catalog identifies all the domestic assistance programs of the Federal Government--459 of them--and provides a brief description of their purposes, etc. Another document, issued by the Vice President's office, entitled "HANDBOOK FOR LOCAL OFFICIALS", serves as a guide to federal assistance primarily for local governments.

In addition to the extensive activities at the federal level, there are developments emerging at the state and local level with regard to stimulating an improvement in the flow of information. For example, efforts are underway for state and local governments to establish joint service bureaus and/or cooperative agreements among various units of government. In Los Angeles County a number of small cities are planning the establishment of their own processing center. For some time, there have been efforts in the state of Iowa to establish a data processing center to serve all levels of government in that state. In fact, this particular proposal has been endorsed by the Council of State Government's Committee on Information Systems. As Bill Gill has pointed out: "Centers

dedicated solely to federal-state-local data processing are viewed as an effective means for dealing with the problems which have slowed EDP progress in a large number of governmental agencies throughout the country. Data processing centers operated by state governments, when made available for the use of counties and cities, have already demonstrated the validity of this point."

Another type of activity is exemplified by the so-called "California Study," which was undertaken in California under the administration of Governor Brown. This study, entitled "THE CALIFORNIA STATEWIDE INFORMATION SYSTEMS STUDY", was undertaken by the Lockheed Missiles and Space Company, a division of Lockheed Aircraft Corporation in Sunnyvale, California; it is one of the studies demonstrating the applicability of aerospace technology skills to government problems. This study resulted in an extensive report which recommended the establishment of a state-wide information system concept. Simply stated, the basic purpose of the concept is to augment the information resources of California's public jurisdictions into a single, integrated system serving the information requirements of individual state and local organizations as well as the needs of the entire state.

It was proposed that the State-Wide Information System be developed as a federation of organizational computer centers (state and local) tied together by an Information Central and operating within a framework of compatibility rules. While the state of the art in terms of the information sciences and technology would permit the implementation

of the Lockheed proposal, the state of the art of politics has impeded the implementation considerably, particularly the intergovernmental relationship aspects. But there has been some progress.

Another type of study, of which the following is only typical, is one made by the firm of Touche, Ross, Bailey and Smart, proposing an area-wide automated data processing system for the city of Memphis and other local government organizations in that area. This particular study recommended a five-year plan for implementation and ultimate automation of the entire information processes of the city and of its interactions with county and other local governmental units. I am sure that there are hundreds of similar cases where progress is being made.

Let me now return to my opening comments about what is happening to a few managers today and what may soon be happening to many. Of course, the technology that I am talking about has great implications for exchange of information; not only will it facilitate person-to-person communications within an organization, but it will also bridge organizations.

It may seem unlikely now, because we are not accustomed to the idea, but within two or three years, according to today's best estimates, it is entirely possible that any well-managed organization will have fifty to a hundred terminals at its headquarters building and branch locations through the country. Through these terminals and by means of complex computer programming, managers in every functional department

will input daily information to, and get timely readings from, one large central computer.

The medium through which these man/computer conversations are to take place is deceptively simple. It consists essentially of two parts: one, a computer terminal (the component physically present to the user) which may take the form either of a teletypewriter or a video screen and keyboard (voice analyzers are not yet perfected); the other, a general purpose data system which, stored in the computer, enables the machine to understand and carry out English-expressed commands.

The prediction that the use of this medium may be widespread in the short-term future is subject to understandable doubt. At the least, it implies that certain prior conditions have been met:

1. That the enabling software exists--as a self-consistent system--in packaged off-the-shelf form. (Otherwise the claim is pure speculation.)

2. That the medium is easy to learn and use (because no company is likely to invest in a massive programmer training course for its management personnel).

3. That the software system is truly generalized--or able to handle a wide variety of data for a wide variety of applica-

tions. (Otherwise extension of this on-line data management capability to all functional areas of the company would require much more than two or three years' time.)

4. That it operates under a time-sharing system (for no company could afford a large private computer for every user).

5. That a management information system based on the framework of an interactive generalized data management system offers significant advantages over standard management reporting systems (or managers would not bother to use the new medium).

At this point, let me simply assert that the medium does exist and the medium unquestionably affects the message it transmits because it opens up a whole new way of thinking and working with information. When the data are organized in one central location, anyone who has a terminal and authorized access to the files can draw out the information he needs. With the data alive and residing in the computer, the user--the manager who bases a decision on his reading of the facts--can review, manipulate, summarize, and recall them at will.

Now I would like to back up a little and review some of the background of the technology that leads to the situation I have just described. This will include equipment and programming and may help

to understand how we get from here to there.

There are many aspects of the technology that one could review. Obviously, computers are "front and center" of any such review. There are also many other devices, such as microform applications, memory storage devices, etc. The possibilities for application seem almost endless, but it may suffice to indicate that the technology resources currently available far exceed any needs and are quite sufficient to meet any requirements for computation, documentation, or communication. A single illustration may help: We now have "micro images" which are micro-photostatic storage devices. One chip, about one inch square, contains the entire Holy Bible. That can indeed be called "storage of information." It is certainly a "small testament" to what is possible.

The real problem, as I view it, is not the device or technology in terms of hardware, but how we organize to use these great resources in terms of systems and people. Computers and storage devices, in and of themselves, are of little value. What counts is how we define our requirements, specify our system, and implement it. The important fact to remember is that the people in the system are all-important and fundamental from the point of view of design, decision making, and control.

Of all the equipment represented in modern technology, computers perhaps have the greatest long-range potential impact for information

handling. These devices, together with associated equipment and procedures, offer the greatest capability for information services of all kinds. The growth in the number and capability of computers is staggering. (See Attachment 2 for statistics in this connection.)

Progress, from the first elementary computers in 1950 to the beginning of the fourth generation of computers in less than two decades, is astounding. The large bulky, first generation, tube computers gave way to a second generation with the arrival of the transistor which decreased the size, increased the speed, etc. The third generation led us to the use of micro-circuitry, which further reduced size. Now there is talk of a fourth generation which would involve further refinements, mass production, and tremendously reduced costs. The day may well come when every individual will feel it advisable to have his own computer! Seriously, the time may soon be here when every line of business may have its specially tailored computer to handle its affairs--the travel office, the insurance brokerage, etc. In this connection, as I discuss some aspects of programming and the great benefits of the current time-sharing movement, we should perhaps pause to realize that a fourth generation of small, low-priced computers may outmode time-sharing.

Now I would like to turn to a discussion of the system implications of information processing. We hear much about the systems approach to management operations in particular, and life in general, and it is certainly true that in the information business the word

"systems" is a very common one. To illustrate the information systems concept, let's consider the short-order restaurant.

As you will notice the next time you are in a coffee shop, there is a spindle somewhere between the kitchen and the counter where the waitresses perform their duties. We have here a simplified example of an effective information system. The order blank that the waitress fills out provides the input. The placement of this input on the spindle puts the information in memory. The spindle itself serves as a buffer between the waitress and the cook. It also provides a queuing device--that is, it lines up the various orders in sequence. It provides a random access display whereby the cook and the waitress can look down the row of orders and see what comes next and what can be combined, etc. The spindle provides control and settles arguments as to priorities, and it clearly provides a record. You will note that these are all operations research terms that are used in the discussion of much more complex and difficult systems.

Let us now take a look at a very complex information system involving the use of immense communications devices and computers. I am referring to the SAGE (Semi-Automatic Ground Environment) System. In the SAGE System the computer is used as a device for many of the same functions that the spindle performs in the short-order restaurant. Information about geography, weather, known plane flights, etc. is stored in the memory of the computer. Radar data converted to digital form and

fed directly into the computer, are computed and sent to the operators. Operators then have the opportunity to react, to ask for more information, to take appropriate action to investigate unidentifiable objects in the air, to guide interceptors to these objects if advisable, etc. The computer operates in what is known as "real" time. It is dealing with current information and enabling men and machines to react as the information is being handled and displayed. This has been a very important and significant development in the history of computer systems and has led to many of the subsequent developments in both space exploration and satellites. Now it is being extended to many commercial applications.

The operation of information systems in real time was a significant development of the late 1950's. One of the most important further developments was the advent of time sharing in the early 1960's. As I indicated earlier, time sharing refers to the systems in which many users share the computer almost simultaneously. That is, each user has the impression of undivided use, although the high-speed computer itself may be serving many while appearing to serve only one. The implications for cost sharing are obvious.

Real time and time sharing have led to new problems and opportunities in computer software. One concern is to develop effective "executive" programs--programs that manage the difficult sharing process. A number of such systems have been developed that are working effectively. A second concern, stemming from the potential for direct interaction

that time sharing makes feasible, is to develop conversational programming languages for the user. Here, too, progress has been made and a number of useful languages have been developed.

Another interesting development of recent date is the new field of data management systems. Several general-purpose programs are currently available for handling simple, tabular files of limited size. These systems permit the non-programmer manager to select categories of data for a report, the non-programmer statistician to perform various analyses, and the non-programmer documentalist to generate a variety of indexes and bibliographies.

A number of data management programs have been developed and are being marketed by manufacturers of computing equipment, as well as by programming firms. These programs all have limitations as to file size, format, types of data that may be manipulated, and computers on which they may be operated. One may expect that new developments as to manageability and speed will be possible within the next few years. For example, at SDC we are making excellent progress in the development of TDMS, a generalized data management program.

Before closing, I would like to add a little more current reality to my opening remarks about the executive and his data bank, because I am sure that some of you are skeptical.

At SDC in Santa Monica we have in current operation what

we call a "Skills Inventory System." In outward appearance, this system operates much as described in my opening story. Data about more than two thousand professional personnel of the company have been placed in the memory of a large computer. This data base, which is updated monthly, contains all of the basic employee information on current assignment, status, background experience, and education. The purposes of the system are two-fold: to identify and describe individuals for transfer to proposed assignments and other special purposes, and to summarize technical capabilities--for instance, the numbers of persons who have performed various kinds of technical work.

This data base was assembled from two sources: questionnaires sent to employees, and already existing data in our automated personnel system. We are able to query this data base in much the same manner as described in my introduction. We type a request on the teletypewriter (the input device to the computer), which asks the computer a question, and the reply can either be a videoscope display or a response on the teletypewriter.

For example, we recently needed to know whether we had any programmers with a certain number of years' experience who were single and possibly available for consideration for assignment in Viet Nam. Within two minutes we had a list of six such programmers. This, of course, enabled us to proceed with interviews and screening to meet this urgent request. Without this kind of help, such simple requests would become tedious, difficult projects.

This is just one of many applications currently in use; I hope it lends some reality to my introductory illustration.

Now, finally, what are the implications of the information sciences for intergovernmental cooperation in communication and exchange of information? Clearly the technology itself offers great possibilities for improvements, and the federal grant-in-aid program will be a great resource for both financial aid and technical help. The state and local governments are making tremendous strides towards improvement in this regard; however, it must be remembered that the man in the system must stay in charge. Care should always be taken that the tail does not wag the dog.

In closing, let me refer to a comment of Norbert Wiener's which he made in 1964:

> "No, the future offers very little hope for those who expect that our new mechanical slaves will offer us a world in which we may rest from thinking. Help us they may, but at the cost of supreme demands upon our honesty and our intelligence. The world of the future will be an even more demanding struggle against the limitations of our intelligence, not a comfortable hammock in which we can lie down to be waited upon by our robot slaves."

ATTACHMENT 1

THE DYNAMICS OF INFORMATION FLOW

Recommendations
to Improve the Flow of Information
within and among
Federal, State and Local Governments

A Report by the
Intergovernmental Task Force
on Information Systems
April 1968

CHAPTER 1

SUMMARY - PLAN OF ACTION

Federal, State and local governments are making increasing demands for better information in order to plan, operate and evaluate programs to meet public needs. As these needs become more complex, many programs are taking the form of co-operative arrangements involving joint action and the sharing of resources by several governmental levels. This development--spurred in recent years by a dramatic increase in Federal aid which in fiscal year 1968 is estimated to be almost $18-billion--is creating a whole new set of working relationships among governments as well as within governments. Manifesting these interrelationships are the greatly expanded co-operative programs to broaden educational opportunities, help economically-depressed areas, provide health and medical care, alleviate poverty, improve transportation facilities and transform blighted neighborhoods.

Intergovernmental approaches to the solution of public problems require that reliable information flow readily among those who share responsibility, so that concerted action may be taken. In general, information systems now in use, and current efforts to improve them, are not geared to satisfy this requirement. The Task Force study revealed that

--it is often difficult to exchange information quickly and economically among governments;
--information is often unreliable, and difficult to summarize and evaluate;
--there is unnecessary duplication of systems dealing with similar kinds of information;
--unreasonable and conflicting demands for information are sometimes placed upon the lower levels of government;
--State and local governments are frustrated in attempts to develop co-ordinated, unified systems;
--scarce resources are being wasted unnecessarily.

These conditions are traceable to a number of factors which impede the development of an efficient flow of useful information. The more important of these are:

1. The lack of strong, central co-ordination at all levels of government over the development and operation of internal information systems.

2. The fragmentation of Federal grant-in-aid programs which are available to assist State and local governments in the development and operation of information systems.

3. The lack of adequate co-ordination among separate Federal and State programs which impose requirements for socio-economic data upon the lower levels of government.

4. The lack of appropriate consultation by Federal and State agencies with lower levels of government prior to imposing requirements for information.

5. The absence of recognized, responsive channels for consultation among Federal, State, and local agencies.

6. The absence of effective controls within Federal and State agencies over the kinds of information and the level of detail required from lower levels of government.

7. The scarcity of technical capabilities and skills in some States and most local governments.

8. The lack of a responsive mechanism whereby successful experiences in the design and operation of information systems can be exploited by other governmental units with similar needs.

9. The absence of recognized standards for data elements and codes having broad usage in co-operative governmental programs.

10. The incompatibility of data processing equipment and related software used by governmental units.

11. The absence of an official central source of information on all Federal assistance programs to help State and local governments in planning for the use of these programs.

It is recognized that some of the impediments cited above are the product of larger issues involving matters of public policy, constitutional and statutory restrictions, and government organization, the legitimate purposes of which are often in conflict with and override the objective of achieving an effective flow of information. Nevertheless, Federal, State and local governments can act in many important ways to improve information systems even within the constraints imposed by these larger issues.

The major recommendations for action are summarized below. Although the recommendations are grouped according to the chapter titles under which they are discussed, all recommendations are interrelated and tend to complement and support one another in their contribution to the over-all objective of better and more responsive information systems.

The agencies that should assume primary responsibility for implementation are indicated in parentheses at the end of each recommendation.

Improving information systems within governments (Chapter 2).

1. Provide for the co-ordinated development of information systems within each government. (U. S. Bureau of the Budget, State governments and local governments.)

2. Enact the proposed Joint Funding Simplification Act being considered by the Congress.

3. Provide information systems for the President, Governors, and Chief Executives of local governments, to facilitate efficient decision-making. These information systems would utilize the other information systems within the government concerned. (Executive Office of the President, State governments and local governments.)

Improving the exchange of information among governments (Chapter 3).

4. Organize active consultation between Federal agencies and State and local governments in the development of intergovernmental information systems in major functional areas such as crime, employment security, health, and education. (Federal agencies.)

5. Develop, under the leadership of the U. S. Bureau of the Budget, a standard "package" of socioeconomic data to be used as a base by Federal agencies in obtaining information from State and local governments. The same package should be used by State governments in obtaining information from local governments.

6. Create a State-Local Information Advisory Council as a means by which Federal agencies may secure representative views of State and local governments. (National Governors' Conference, Council of State Governments, The National Association of Counties, National League of Cities, U. S. Conference of Mayors, and International City Managers' Association.)

7. Create a Local Information Advisory Council within each State to promote effective consultation between the State and local agencies. (State governments.)

8. Require evidence of consultation with State and local agencies (or representative bodies) before approving Federal agency requests for information levied on such agencies. (U. S. Bureau of the Budget.)

9. Co-ordinate and audit periodically the information requirements imposed on other levels of government by Federal and State agencies. (U. S. Bureau of the Budget and State governments.)

Strengthening information systems at the local level (Chapter 4).

10. Pool the resources of local government to launch a program of mutual assistance in upgrading local information systems. (State-Local Information Advisory Council recommended in Chapter 3).

11. Enact the Intergovernmental Co-operation Act and the Intergovernmental Manpower Act being considered by the Congress.

Sharing systems knowledge (Chapter 5).

12. Create an Intergovernmental Information Systems Exchange to (a) serve as a clearinghouse on information systems which are used or are being developed by local, State and Federal governments, and (b) promote compatibility among such systems. (Advisory Commission on Intergovernmental Relations.)

13. Establish and operate the Intergovernmental Information Systems Exchange under the auspices of the Advisory Commission on Intergovernmental Relations, assisted by a Steering Committee representing all governmental levels. (Advisory Commission on Intergovernmental Relations.)

14. Support the Intergovernmental Information Systems Exchange by advance financial contributions from all levels of government. (Federal, State and local governments.)

Achieving compatibility among systems (Chapter 6).

15. Accelerate the recently-established Federal Government program for the development of standard data elements and codes, particularly in major functional areas, and consult actively in an organized fashion with State and local governments where such data elements and codes interact with their systems. (U. S. Bureau of the Budget and Federal agencies.)

16. Provide for active participation by State and local govern-

ments in the national program for the development of information processing standards being conducted under the auspices of the USA Standards Institute (USASI), to augment and complement the considerable efforts now being devoted to this program by the Federal Government. (State-Local Information Advisory Council recommended in Chapter 3.)

17. Implement approved information processing standards at the State and local levels of government, based upon recommendation of the national associations which represent these governments. (State-Local Information Advisory Council recommended in Chapter 3, and State and local governments.)

Improving information about Federal assistance programs (Chapter 7).

18. Designate a Federal Information Center on Assistance Programs to serve as the primary national source of information on these programs.

Guidelines for action (Chapter 8).

19. Issue guidelines to be used by Federal agencies for cooperating with and assisting State and local governments in improving the flow of information within and among governments. (U. S. Bureau of the Budget.)

20. Issue similar guidelines to be used by States and major local governments. (States and major local governments.)

ATTACHMENT 2

In 1955, there were fewer than 1,000 general-purpose, stored-program, digital computers in the world, about 700 of them in the U.S. By 1975, there may be 250,000. A good estimate for 1968 would be more than 90,000--including Eastern European and defense computers not ordinarily counted. The following table gives estimates and predictions of the number of the world's computers. The number of computing centers would be somewhat less, since a great many have several computers.

Number of Computers

(in thousands)

1960	1965	1968	1970	1975	
6	30	60	80	150	United States
.4	1.8	5	7	13	West Germany
.04	1.6	4	6	14	Japan
.6	1.4	3.8	5.3	10	United Kingdom
.5	1.2	3.6	5	9	France
.4	.8	2.6	3.7	7	Italy
.6	2.2	7	12	29	Other OECD Nations
8.5	39	86	119	232	Total, OECD Nations
.8	2	3	4	8	U.S.S.R.
.2	1.5	3.5	5	10	All other nations
9.5	42.5	92.5	128	250	Total, All Nations

The estimated four-fold increase in the total number of the world's computers from 1960 to 1965 corresponds to an annual growth rate of more than one-third. The predicted three-fold increase from 1965 to 1970 corresponds to an annual growth rate of almost one-quarter. And the projected two-fold increase from 1970 to 1975 corresponds to an annual growth rate of about eleven per cent. During the same periods, advances in computer hardware resulted in the following increases in the computational power of the average computer: ten-fold from 1960 to 1965; three-fold from 1965 to 1970; two-fold from 1970 to 1975. These averages are lowered by the continued use of older computers and thus do not match the improvements in the state of the art. Nevertheless, they betoken forty-fold, nine-fold, and four-fold increases in the world's total computational capacity for the three periods, thus computational capacity has increased by almost 1,500 times during the 1960-1975 period.

The growth in number of computers is matched by a corresponding growth in computer peripheral equipment, such as line printers, cathode-ray-tube displays, typewriter teleterminals, magnetic disk and drum stores, paper tape and card readers and punches, magnetic tape drives, and data transmission equipment. Unfortunately, there have been relatively small (2- or 3-fold) gains in the cost/performance of this equipment over the years, as compared to the computers' central processing units. Consequently, the cost of peripheral equipment is becoming an increasingly larger part of the total hardware cost of a computer, as shown in the following table.

Per Cent of Hardware Costs for

Peripheral Equipment

1960	1965	1968	1970	1975
50%	60%	65%	70%	80%